

REFERENCES

- BARKER, S. G. (1921): The Shellac industry and its possibilities in Travancore. *Bull. Dept. Indus. Govt. Travancore*, No. 7.
- DAS GUPTA, J. M. & MEHRA, B. P. (1967): Recorded and unrecorded lac-hosts from West Bengal. *Indian Forester*, 93 (5).
- GHOSE, S. K. (1963): Lac insects (Lacciferidae, Hemiptera) from West Bengal. *Indian Agric.* 7 (1 & 2).
- KASHYAPA, G. (1961): *Shorea talura* Roxb., a synonym of *S. roxburghii* G. Don. *J. Bombay nat. Hist. Soc.*, 58 (2).
- MAHESHWARI, J. K. (1963): The Flora of Delhi. Council of Scientific and Industrial Research, New Delhi.
- MEHRA, B. P. & GOKULPURE, R. S. (1967): Recorded and unrecorded lac-hosts from Madhya Pradesh. *Indian Forester* 93 (10).
- PRASAD, U. N. & MEHRA, B. P. (1967): A new record of *rangeeni* lac on *Grevillea robusta* A. Cunn. (Fam. Proteaceae) from Namkum, Ranchi. *Indian Forester*, 93 (6). [*Vide*, No. 119 in the main list].
- RAIZADA, M. B. (1966): Nomenclatural changes in Indian plants. *Indian Forester* 92 (5).
- SANTAPAU, H. (1967): The flora of Khandala on the Western ghats of India. 3rd revised ed. *Rec. Bot. Surv. India* 16 (1).

25. PARASITES, PREDATORS AND OTHER NATURAL ENEMIES OF SUGARCANE PESTS IN MAHARASHTRA

Sugarcane is one of the major commercial crops extensively grown in Maharashtra State, in an area of about 3.75 lakh acres. Forty-four species of pests including borers, fulgorids, coccids, etc. have been recorded to infest the crop and they are a serious menace to its successful cultivation. Of these, the internal feeders are very difficult to control with modern pesticides. Attempts are therefore being made in various countries for their successful control through large scale use of their natural enemies, thereby saving huge annual losses.

A beginning in this direction has already been made in India and various workers have recorded several natural enemies of sugarcane pests in States like Mysore, Bihar, Madras, etc. Krishnamurti & Usman (1954) have described about 20 different parasites on sugarcane pests while Gupta (1954), and Gupta & Awasthi (1956) have given a brief account of the parasites of sugarcane pests recorded in north India. Butani (1958) has listed about 99 species of parasites and predators recorded on the pests of sugarcane throughout India. A brief account of about 40 natural enemies recorded in Mysore State with details of their alternate hosts, time of occurrence, the percentage parasitization etc. is given by Shivashankara Sastry & Appana (1958). Besides recording the natural enemies, attempts for large scale multiplication of the promising species with a view to controlling the noxious pests, have also been made. (Puttarudriah & Usman 1958, Puttarudriah & Sastry 1958, Subramaniam 1937, Tirumala Rao *et al.* 1954).

However, in Maharashtra, the use of these natural enemies in controlling harmful pests of sugarcane has not been fully exploited except

TABLE

Sr. No.	Parasite or Predator	Host recorded in Maharashtra	Locality	Period of maximum activity	Previous records and references
Parasites					
Order HYMENOPTERA					
Family Braconidae					
1.	<i>Apanteles taprobanae</i> Cam.	Eggs of Stem borer, <i>Chilo-traea infuscatellus</i> Sn.	Padegaon, Satara	August	Recorded at Bangalore on crab caterpillar <i>Stauropus alternus</i> Wlk. infesting tur (<i>Cajanus</i>) (Krishnamurti & Usman 1954).
2.	<i>Stenobracon deesae</i> Cam.	Larvae/pupae of <i>Scirpophaga nivella</i> F. (Top-shoot borer)	"	June & August	Recorded in Bihar, Madras, Mysore, Punjab, U.P., on <i>S. nivella</i> F.; <i>B. stenella</i> , <i>C. zonellus</i> S., <i>C. infuscatellus</i> Sn., <i>C. auritella</i> , & Usman 1958, Krishnamurti & Usman 1954).
3.	<i>Apanteles flavipes</i> Cam.	Larvae of <i>C. infuscatellus</i> Sn. (Stem borer)	"	October to January	Recorded as a larval parasite of <i>Sesamia inferens</i> Wlk., <i>Chilo zonellus</i> S., <i>C. infuscatellus</i> and hairy caterpillar, <i>Amsacta albistriga</i> Wlk. in Bangalore & Mandya. (Krishnamurti & Usman 1954) Butani (1958) reported it from Bihar, Madras and U.P. on <i>S. nivella</i> , <i>Chilo zonellus</i> , <i>C. infuscatellus</i> , <i>P. indicus</i> etc.
Family Scelionidae					
4.	<i>Telenomus dignus</i> G.	Eggs of <i>S. nivella</i> F. (Top-shoot borer)	"	July & August	First record in Maharashtra.
5.	<i>T. dignoides</i> N.	Eggs of <i>S. nivella</i> F.	"	June to August	Eggs of <i>S. nivella</i> in Mysore. (Krishnamurti & Usman 1954)

Sr. No.	Parasite or Predator	Host recorded in Maharashtra	Locality	Period of maximum activity	Previous records and references
6.	<i>Telenomus</i> sp.	Eggs of <i>Chiloatraea infuscatellus</i> Sn.	Lakhmapur, Nasik	July & August	Eggs of ragi stem borer (<i>Sesamia inferens</i> Wlk.) in Mysore, (Krishnamurti & Usman 1954).
7.	<i>T. beneficiens</i> Zehnt.	Eggs of <i>S. nivella</i> F.	Padegaon, Satara	July	Recorded as an egg parasite of <i>C. infuscatellus</i> , <i>P. indicus</i> , <i>S. nivella</i> F. and paddy stem borer <i>S. bipunctifer</i> Wlk. in Mysore. In Maharashtra, reported to parasitize the eggs of various sugarcane borers (Anonymous 1953).
Family	Eulophidae				
8.	<i>Tetrastichus pyrillae</i> Craw.	Eggs of <i>Pyrilla</i> sp.	,,	July	It is reported from Bihar, Delhi Hyderabad, Punjab, Mysore, U.P. as an egg parasite of <i>Pyrilla perpusilla</i> Wlk. (Butani 1958) Narayanan & Kundanial studied its bionomics in 1953.
9.	<i>Tetrastichus</i> sp.	Eggs of <i>Scirpophaga nivella</i> F.	,,	November	Recorded at first by Subramanyam in 1939 as an egg parasite of <i>nivella</i> in Mysore.
10.	<i>Tetrastichus</i> sp.	Pupae of <i>Sesamia inferens</i> Wlk.	,,	July	Reported as pupal parasite of <i>C. infuscatellus</i> and <i>S. nivella</i> . (Anonymous 1958).
Family	Trichogrammatidae				
11.	<i>Trichogramma</i> sp.	Eggs of <i>Chiloatraea infuscatellus</i>	,,	July-August	Egg parasite of ragi stem borer <i>S. inferens</i> Wlk. (Krishnamurti & Usman 1954). Some other species of this genus have also been reported to parasitise the eggs of <i>C. infuscatellus</i> Sn. and <i>S. nivella</i> F. in Mysore (Shivashankara Sastry & Appana 1958).

Sr. No.	Parasite or Predator	Host recorded in Maharashtra	Locality	Period of maximum activity	Previous records and references
12.	Encyrtidae <i>Anabrolepis</i> sp.	Scale insects, <i>Aspidiotus glomeratus</i> G.	Lakhmapur, Nasik	Sept. Dec.	First recorded in Maharashtra in 1963. Narayanan <i>et al.</i> (1957) reported <i>Anabrolepis mayurai</i> as a primary parasite of sugarcane scales. (<i>A. glomeratus</i> G.). Recorded for the first time in 1939 by Mani in the Puniab. Reported on various coccids infesting sugarcane including <i>Saccaricoccus sacchari</i> Ckll. (Butani 1958, Krishnamurti & Usman 1954, Shivashankara Sastry & Appana 1958).
13.	<i>Anagyrus saccharicola</i> Timb.	Mealy bugs, <i>Trionymus sacchari</i> Ckll.	Hadapsar, Poona	June & July	Reported as a larval parasite of <i>Scirpophaga</i> sp. by Cherian & Israel (1937). It was also reported from Java, Formosa and north India.
14.	<i>Elasmus zentneri</i> Ferr.	Pupae of <i>S. nivella</i> F.	Padegaon, Satara	January	Previously reported as <i>Sturmiopsis semiberbis</i> Bezzi on the larvae of <i>S. inferens</i> Wlk. in Bangalore Mandya and Chitaldrug (Krishnamurti & Usman 1954). It is also recorded on the larvae of <i>Chilo zonellus</i> S. and <i>C. infuscatellus</i> P. (Shivashankara Sastry & Appana 1958).
15.	Tachinidae <i>Sturmiopsis inferens</i>	Larvae of internode borer <i>Sesamia inferens</i> Wlk.	Order DIPTERA "	March to May	

Sr. No.	Parasite or Predator	Host recorded in Maharashtra	Locality	Period of maximum activity	Previous records and references
16.	<i>Mepachymerus tenellus</i> Beck.	Larvae of <i>C. infuscatellus</i> Sn.	"	February	Recorded for the first time in Maharashtra in the year 1963.
17.	<i>Scolioptthalmus micans</i> Lamb.	Larvae of top-shoot borer <i>Scirpophaga nivella</i> F.	"	February	First recorded in Maharashtra State in 1965.
Predators					
Order COLEOPTERA					
Family	<i>Coccinellidae</i>				
18.	<i>Nephus</i> sp.	Mealy bugs <i>Trionymus sachari</i> Ckll.	Lakhmapur, Nasik	June & July	Reported on cotton aphids, <i>Aphis gossypii</i> Gl. from Mysore (Puttarudriah & Channa Basavanna 1957).
19.	<i>Chilocorus nigritus</i> Fb.	Castor scales <i>Sessetia nigra</i> on castor and <i>Aspidiotus glomeratus</i> G. on sugarcane	Deolali, Nasik	May-June, October, November	Described by Stebbing (1903). Polyphagous species feeding on coccids, aphids, aleurodids, psyllids etc.
20.	<i>Pharoscyrnus horni</i> W.	Sugarcane scales <i>Aspidiotus glomeratus</i> G.	Lakhmapur, Nasik	Reported from tropical countries. In Indian Union, recorded from Mysore, Madras, M.P. etc., on sugarcane mealy bugs <i>T. sachari</i> Ckll. and hard scales infesting other crops (Puttarudriah & Channa Basavanna 1956).	
Entomogenous Fungi					
21.	<i>Sporotrichum</i> sp.	Sugarcane scales, <i>A. glomeratus</i> G.	Entomology Section, Poona	Recorded for the first time in the year 1965 in Maharashtra State.	
22.	<i>Fusarium</i> sp.	"	"	"	

for the attempts made for large scale multiplication of *Trichogramma minutum* Riley and *Tetrastichus* sp. egg and pupal parasites respectively, for the control of sugarcane borers (Bagal & Patel 1952; Anonymous 1958). It was, therefore, felt necessary to carry out detailed survey of the major sugarcane growing areas of the State and record natural enemies of the pests of sugarcane crop. The information regarding the host-range, locality, period of occurrence etc. of the various species recorded is given above in a tabular form which would be useful in undertaking further work on successful utilization of some of the promising natural enemies in controlling these pests.

ENTOMOLOGY SECTION,
COLLEGE OF AGRICULTURE,
POONA-5,
May 17, 1967.

S. K. DORGE
V. P. DALAYA
A. G. PRADHAN

REFERENCES

- ANONYMOUS (1953 & 1958): Annual progress report of scheme for studies of sugarcane pests, Walchandnagar, by Govt. of Maharashtra.
- BAGAL, S. R. & PATEL, G. A. (1952): Sugarcane stem borer and its control by use of *Trichogramma* parasites, *Farmer Bombay* 3 (8): 1-2.
- BUTANI, D. K. (1958): Parasites and predators recorded on sugarcane pests in India. *Indian J. Ent.* 20 (4): 270-282.
- CHERIAN, M. C. & ISRAEL, P. (1937): Studies on *Elasmus zehnteneri* F. a parasite of sugarcane white moth. *Madras Agric. J.* 25 (9): 273-279.
- GUPTA, B. D. (1954): A note on the scope of biological control, of sugarcane pests. The second biennial, conference of sugarcane Research and Development Workers, India. By Indian Central Sugarcane Committee, New Delhi: 229-233.
- & AWASTHI, P. N. (1956): Recent advances in sugarcane entomology in India. *Indian sugar* 5: 541-548.
- KRISHNAMURTI & USMAN (1954): Some insect parasites of economic importance noted in Mysore State. *Indian J. Ent.* 16 (4): 327-344.
- MANI, M. S. (1939): Description of new records of some known Chalcidid and other hymenopterous parasites from India. op. cit. 1 (1 & 2): 68-99.
- NARAYANAN, E. S. & KUNDANLAL (1953): Studies on Chalcid egg parasite of *Pyrilla* sp. occurring in Delhi. op. cit. 15 (3): 173-179.
- , SUBBA RAO, B. R. & KAUR, R. B. (1957): Some known and new records of parasites of sugarcane scale insects from India. op. cit. 19 (2): 144-146.
- PUTTARUDRIAH, M. & CHANNA BASVANNA, G. P. (1956): Some beneficial coccinellids of Mysore. *J. Bombay nat. Hist. Soc.* 54 (1): 156-159.
- & ————— (1957): Some insect predators of aphids in Mysore. *Mysore Agric. J.* 32 (3-4): 158-161.
- & SHIVASHANKARA SASTRY (1958): Studies on the biology of *Tetrastichus ayyari* R. with attempts to utilize it in the control of sugarcane borers. *Indian J. Ent.* 20 (3): 189-198.
- & USMAN, S. (1958): Brief notes on recent investigations on some beneficial parasites in Mysore. *Mysore Agric. J.* 33 (2): 76-79.
- SHIVASHANKARA SASTRY & APPANA, M. (1958): Parasites and predators of some common insect pests of sugarcane in Visvesvarayya canal tract, Mandya District, Mysore State. op. cit. 33 (3): 143-153.
- SUBRAMANYAM, T. V. (1937): Preliminary experiment on mass production of *Trichogramma* parasite for control of sugarcane borers in Mysore. *Indian J. Agric. Sci.* 8 (1): 149-155.
- STEBBING, E. P. (1903): Predaceous coccinellidae of Indian region. *Indian Museum Notes* 6 (1): 47-62.
- TIRUMALA RAO, LEELA DAVID, V. & MOHAN RAO, K. R. (1954): Attempts at the utilization of *Chilocorus nigrinus* F. in Madras State. *Indian J. Ent.* 16 (3): 205-209.